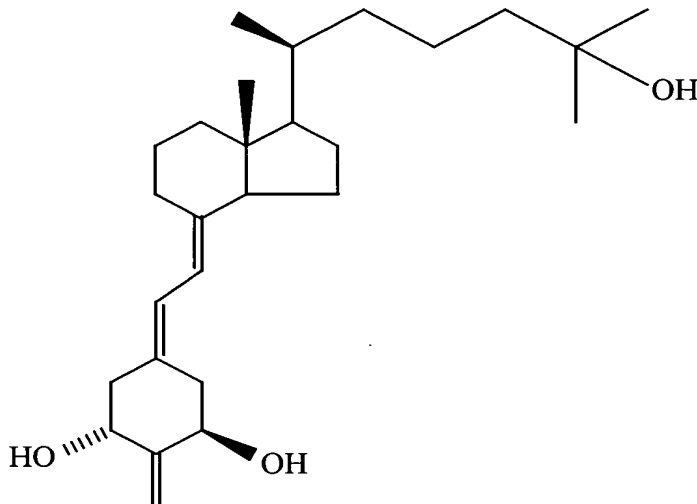


## CLAIMS

**We claim:**

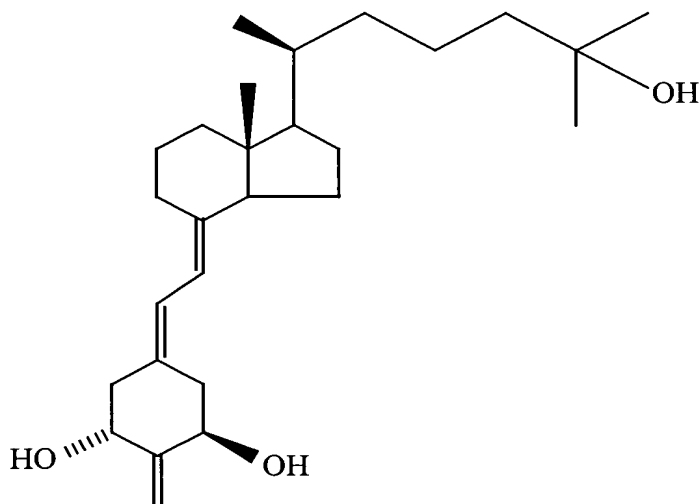
1. A method for prophylaxis of a disease characterized by a need to increase the strength of a bone comprising administering to a subject an effective amount of 2-methylene-19-nor-20(S)-1 $\alpha$ ,25-dihydroxyvitamin D<sub>3</sub> having the formula:



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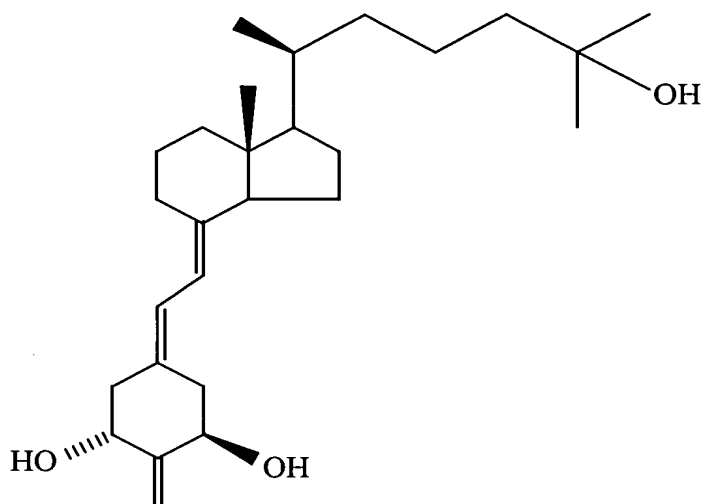
2. The method of claim 1 wherein the bone strength is cortical strength.
3. The method of claim 1 wherein the bone strength is trabecular strength.
4. The method of claim 1 wherein 2-methylene-19-nor-20(S)-1 $\alpha$ ,25-dihydroxyvitamin D<sub>3</sub> is administered orally.
5. The method of claim 1 wherein 2-methylene-19-nor-20(S)-1 $\alpha$ ,25-dihydroxyvitamin D<sub>3</sub> is administered parenterally.
6. The method of claim 1 wherein 2-methylene-19-nor-20(S)-1 $\alpha$ ,25-dihydroxyvitamin D<sub>3</sub> is administered transdermally.
7. The method of claim 1 wherein the disease is low bone turnover osteoporosis.
8. The method of claim 1 wherein the disease is steroid induced osteoporosis.

9. The method of claim 1 wherein the disease is senile osteoporosis.
10. The method of claim 1 wherein the disease is postmenopausal osteoporosis.
11. The method of claim 1 wherein the disease is osteomalacia.
12. The method of claim 1 wherein 2-methylene-19-nor-20(S)-1 $\alpha$ ,25-dihydroxyvitamin D<sub>3</sub> is administered to a human in a dosage of from about 0.01  $\mu$ g to about 100  $\mu$ g per day.
13. The method of claim 1 wherein 2-methylene-19-nor-20(S)-1 $\alpha$ ,25-dihydroxyvitamin D<sub>3</sub> is administered to a human in a dosage of from about 0.1  $\mu$ g to about 10  $\mu$ g per day.
14. The method of claim 1 wherein 2-methylene-19-nor-20(S)-1 $\alpha$ ,25-dihydroxyvitamin D<sub>3</sub> is administered to an animal in a dosage of from about 0.0001 $\mu$ g to about 700  $\mu$ g per day.
15. A method for prophylaxis of osteoporosis comprising administering to a subject an effective amount of 2-methylene-19-nor-20(S)-1 $\alpha$ ,25-dihydroxyvitamin D<sub>3</sub> having the formula:



16. The method of claim 15 wherein 2-methylene-19-nor-20(S)-1 $\alpha$ ,25-dihydroxyvitamin D<sub>3</sub> is administered orally.

17. The method of claim 15 wherein 2-methylene-19-nor-20(S)-1 $\alpha$ ,25-dihydroxyvitamin D<sub>3</sub> is administered parenterally.
18. The method of claim 15 wherein 2-methylene-19-nor-20(S)-1 $\alpha$ ,25-dihydroxyvitamin D<sub>3</sub> is administered transdermally.
19. The method of claim 15 wherein said osteoporosis is low bone turnover osteoporosis.
20. The method of claim 15 wherein said osteoporosis is steroid induced osteoporosis.
21. The method of claim 15 wherein said osteoporosis is senile osteoporosis.
22. The method of claim 15 wherein said osteoporosis is postmenopausal osteoporosis.
23. The method of claim 15 wherein 2-methylene-19-nor-20(S)-1 $\alpha$ ,25-dihydroxyvitamin D<sub>3</sub> is administered to a human in a dosage of from about 0.01  $\mu$ g to about 100  $\mu$ g per day.
24. The method of claim 15 wherein 2-methylene-19-nor-20(S)-1 $\alpha$ ,25-dihydroxyvitamin D<sub>3</sub> is administered to a human in a dosage of from about 0.1  $\mu$ g to about 10  $\mu$ g per day.
25. The method of claim 15 wherein 2-methylene-19-nor-20(S)-1 $\alpha$ ,25-dihydroxyvitamin D<sub>3</sub> is administered to an animal in a dosage of from about 0.0001  $\mu$ g to about 700  $\mu$ g per day.
26. A method of preventing development of or delaying onset of a disease characterized by a need to increase the strength of a bone comprising administering to a subject an effective amount of 2-methylene-19-nor-20(S)-1 $\alpha$ ,25-dihydroxyvitamin D<sub>3</sub> having the formula:



27. The method of claim 26 wherein 2-methylene-19-nor-20(S)-1 $\alpha$ ,25-dihydroxyvitamin D<sub>3</sub> is administered orally.

28. The method of claim 26 wherein 2-methylene-19-nor-20(S)-1 $\alpha$ ,25-dihydroxyvitamin D<sub>3</sub> is administered parenterally.

29. The method of claim 26 wherein 2-methylene-19-nor-20(S)-1 $\alpha$ ,25-dihydroxyvitamin D<sub>3</sub> is administered transdermally.

30. The method of claim 26 wherein 2-methylene-19-nor-20(S)-1 $\alpha$ ,25-dihydroxyvitamin D<sub>3</sub> is administered to a human in a dosage of from about 0.01  $\mu$ g to about 100  $\mu$ g per day.

31. The method of claim 26 wherein 2-methylene-19-nor-20(S)-1 $\alpha$ ,25-dihydroxyvitamin D<sub>3</sub> is administered to a human in a dosage of from about 0.1  $\mu$ g to about 10  $\mu$ g per day.

32. The method of claim 26 wherein 2-methylene-19-nor-20(S)-1 $\alpha$ ,25-dihydroxyvitamin D<sub>3</sub> is administered to an animal in a dosage of from about 0.0001  $\mu$ g to about 700  $\mu$ g per day.

33. The method of claim 26 wherein said disease is selected from the group consisting of osteoporosis and osteomalacia.

34. The method of claim 33 wherein said osteoporosis is low bone turnover osteoporosis.

35. The method of claim 33 wherein said osteoporosis is steroid induced osteoporosis.

36. The method of claim 33 wherein said osteoporosis is senile osteoporosis.

37. The method of claim 33 wherein said osteoporosis is postmenopausal osteoporosis.

38. A method of preventing bone fractures in a horse comprising administering to a horse an effective amount of 2-methylene-19-nor-20(S)-1 $\alpha$ ,25-dihydroxyvitamin D<sub>3</sub>.

39. The method of claim 38 wherein said horse is a race horse.

40. The method of claim 38 wherein said effective amount comprises about 0.01  $\mu$ g per day to about 700  $\mu$ g per day.

41. A method of preventing bone fractures in a cow comprising administering to a cow an effective amount of 2-methylene-19-nor-20(S)-1 $\alpha$ ,25-dihydroxyvitamin D<sub>3</sub>.

42. The method of claim 41 wherein said cow is a lactating cow.

43. The method of claim 41 wherein said effective amount comprises about 0.01  $\mu$ g per day to about 550  $\mu$ g per day.

44. A method of preventing bone fractures in a pig comprising administering to a pig an effective amount of 2-methylene-19-nor-20(S)-1 $\alpha$ ,25-dihydroxyvitamin D<sub>3</sub>.

45. The method of claim 44 wherein said pig is a sow.

46. The method of claim 44 wherein said effective amount comprises about 0.005  $\mu$ g per day to about 225  $\mu$ g per day.

47. A method of preventing bone fractures in a laying hen comprising administering to a laying hen an effective amount of 2-methylene-19-nor-20(S)-1 $\alpha$ ,25-dihydroxyvitamin D<sub>3</sub>.

48. The method of claim 47 wherein said laying hen is selected from the group consisting of a chicken, a turkey, a duck, a goose, a pheasant, a grouse, an ostrich and a quail.

49. The method of claim 47 wherein said effective amount comprises about 0.0001  $\mu\text{g}$  per day to about 4  $\mu\text{g}$  per day.

50. A method of increasing eggshell strength of a laying hen comprising administering to a laying hen an effective amount of 2-methylene-19-nor-20(S)-1 $\alpha$ ,25-dihydroxyvitamin D<sub>3</sub>.

51. The method of claim 50 wherein said laying hen is selected from the group consisting of a chicken, a turkey, a duck, a goose, a pheasant, a grouse, an ostrich and a quail.

52. The method of claim 50 wherein said effective amount comprises about 0.0001  $\mu\text{g}$  per day to about 4  $\mu\text{g}$  per day.

53. A method of preventing bone fractures in an amenorrheic woman comprising administering to an amenorrheic woman an effective amount of 2-methylene-19-nor-20(S)-1 $\alpha$ ,25-dihydroxyvitamin D<sub>3</sub>.

54. The method of claim 53 wherein said amenorrheic woman is an athlete.

55. The method of claim 53 wherein said effective amount comprises about 0.01  $\mu\text{g}$  per day to about 100  $\mu\text{g}$  per day.

56. The method of claim 53 wherein said effective amount comprises about 0.1  $\mu\text{g}$  per day to about 10  $\mu\text{g}$  per day.

57. A method of preventing bone fractures in an astronaut comprising administering to an astronaut an effective amount of 2-methylene-19-nor-20(S)-1 $\alpha$ ,25-dihydroxyvitamin D<sub>3</sub>.

58. The method of claim 57 wherein said astronaut is a female.

59. The method of claim 57 wherein said astronaut is a male.

60. The method of claim 57 wherein said effective amount comprises about 0.01 µg per day to about 100 µg per day.

61. The method of claim 57 wherein said effective amount comprises about 0.1 µg per day to about 10 µg per day.

62. A method of preventing bone fractures in an athlete comprising administering to an athlete an effective amount of 2-methylene-19-nor-20(S)-1α,25-dihydroxyvitamin D<sub>3</sub>.

63. The method of claim 62 wherein said athlete is a female.

64. The method of claim 62 wherein said athlete is a male.

65. The method of claim 62 wherein said effective amount comprises about 0.01 µg per day to about 100 µg per day.

66. The method of claim 62 wherein said effective amount comprises about 0.1 µg per day to about 10 µg per day.

67. The method of claim 62 wherein said athlete is selected from the group consisting of runners, discus throwers, hammer throwers, weightlifters, soccer players, tennis players, football players and baseball players.